Northern Illinois University

Speech Language Follow-up Study: *Predictability of Early Measurements*

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Abstract: With in the field of speech language pathology there is much research concerning predictability of children's early speech language measurements in contrast to their language level later on. However, among this research much is variable among agreement. The acquired speech language skills of toddlers aged 21-24 months from the DeKalb, IL area were assessed by using standardized and non-standardized measures. The initial testing was completed by Dr. Sherrill Morris. She assessed the early communication skills using the Macarthur Communication Developmental Inventory and Ages and Stages Developmental Screenings. A language sample analyses was also recorded. From this sample population, we took three middle class white males and reassessed their speech language skills three years later. A standardized articulation test, phonological processing test, and a language test were administered at this time. The purpose of this retesting was to determine if early speech behaviors can be predict later communication skills. A study conducted by Alan B. Smith influenced the research question proposed. Smith and his colleagues evaluated whether developmental reading disability could be predicted at the age of 30 months. The measures that he used were very similar to ours: the reason why we used his study and based it off of our findings. We tested three children who were typical at 21-24 months of age. Three years later when follow-up assessment was completed Subject H is found to by atypical and can be said to have a mild/speech language impairment. His score on the GFTA, (standard articulation test) 14% tile, categorizes him as atypical. We can ask ourselves was there something different in his early measurements than the other two subjects? Subject H had a faster articulation rate than subject D and subject C. However, there is no known normal articulation rate found for toddlers which does imply the large range for this measure.

Introduction:

The focus of the work that I am proposing assesses the acquired speech language skills of toddlers aged 21-24 months from the Dekalb, IL area. The vocabulary and phonological skills of toddlers using standardized and non-standardized measures were completed. The initial testing, performed by Dr. Sherrill Morris, assessed the early communication skills using the Macarthur Communicative Development Inventory and Ages and Stages Developmental Screenings. A language sample analyses was also recorded, this can be defined as a parent-child play interaction in which mother and child engage in normal play. From this sample were we able to calculate proportion of pausing time, articulation rate, speaking rate, and mean length utterance. Proportion of pausing time is the sum of all duration of pauses divided by the sum of the duration of the phonetic phrases. Articulation rate is the number of syllables divided by the phonetic phrase duration minus the pauses. Speaking rate is the number of all syllables divided by the sum of all phonetic phrase duration including pauses. Finally mean length utterance is the number of syllables divided by the number of phonetic phrases. With this said, the focus of the study was to take three subjects from this initial study and reassess their speech language skills three years later, developing this research question: Can early speech behaviors predict later communication skills? Restating this by using the data from the initial sample, can this allow us to make early predictive measures on future speech skills?

Follow-up Assessment:

Three subjects from the initial study were reassessed three years later. The demographic information of these three subjects included that these subjects were male,

came from middle class homes, white, aged 61-64 months, and each were monolingual American English speakers.

Hypotheses:

Two hypotheses were developed for this study. The first one being that articulation rate at age 21-24 months is correlated with overall language skills at age 5 years. The second hypothesis that was considered, was expressive vocabulary at age 21-24 months is correlated with expressive vocabulary at age 5 years.

Procedures of the follow-up Assessment:

Procedures of the follow-up Assessment consisted first of a hearing screening where the child wore headphones and raised their hand when they heard a sound, was given. A standardized articulation test, *Goldman-Fristoe Test of Articulation*, where the child will name pictures was administered. A standardized phonological processing test, *Comprehensive Test of Phonological Processing*, where the child is assessed on pre-literacy skills was administered. A standardized language test, *Clinical Evaluation of Language Fundamentals-P2*, where the child will be asked to repeat sentences and repeat sentences in context was administered. Lastly, a parent-child play interaction for recording was done as well. The *Comprehensive Test of Phonological Processing* contains three sub-tests: Phonological Awareness, Memory and Naming. Phonological Awareness involves segmenting sounds in words. For example, the test administer would say to the child, "Say K...ae...t, without the ae." Digits and non-word repetition were apart of the Memory sub-test and naming colors apart of Naming sub-test. *The Clinical Evaluation of Language Fundamentals-P2* also contains three sub-tests: Core-Language, Expressive Language, and Language Structure. Core Language had the child choosing

two things that go together. Vocabulary and sentence repetition was apart of the Expressive Language sub-test. The Language Structure sub-test assessed the child on how well he or she finished sentences. For example, the test administer would say, "One horse, two"_____. The child here would say horses.

Previous Research:

A study conducted by Alan B. Smith and colleagues influenced the research question that was stated previously. Let's begin with the outline of his study, following the results and concluding with the differences between his study and the current study. Smith and colleagues (2006) evaluated whether developmental reading disability could be predicted at the age of 30 months. The measures that were used in this finding were speaking rate, pause time, and articulation rate. There were 28 children tested at 30 months using three measures (speaking rate, pause time, and articulation rate): 18 children at high risk reading impairment based on family history (at least one parent of the child had a history of reading disability) and 10 children at low risk reading impairment based on family history. A reading evaluation at 9 years of age identified nine children within the high risk reading disability group as having a reading disability and the ten children at low risk were tested negative for reading disability. The results of the Smith Study showed that children with reading disability showed a slower speaking rate than children who are at high risk without reading disability. Children with reading disability contained more pause time in their speech as compared to other groups. To finish, articulation rate did not differ greatly across the groups.

Differences between Current study and Smith, et al (2006)

Smith, et al (2006)	Morris & Kazmierczak
Language Sample	Language Sample
- Child + research assistant	- Child + mother
- Speaking rate	- Articulation rate
- Pausing time (b/w .25 & 2.5 Sec)	- Pausing time (b/w .25 & 2.5 Sec)
- Phonetic phrase	- Speaking rate
	- Phonetic phrase

Outlined here are the differences between the two studies. It is important to clarify that Smith defined a phonetic phrase as speaking turns bounded by the speech of others, where we recognized the linguistic cues.

Graphic Representations:

Early Measures

Subjects	Pause Time	Articulation Rate	Speaking Rate	MCDI	MLU
H	0.078	1.756	1.62	177 (50%)	1.24
D	0.11	1.19	1.05	236 (75%)	1.27
C	0.038	0.69	0.66	174 (30%)	1.08

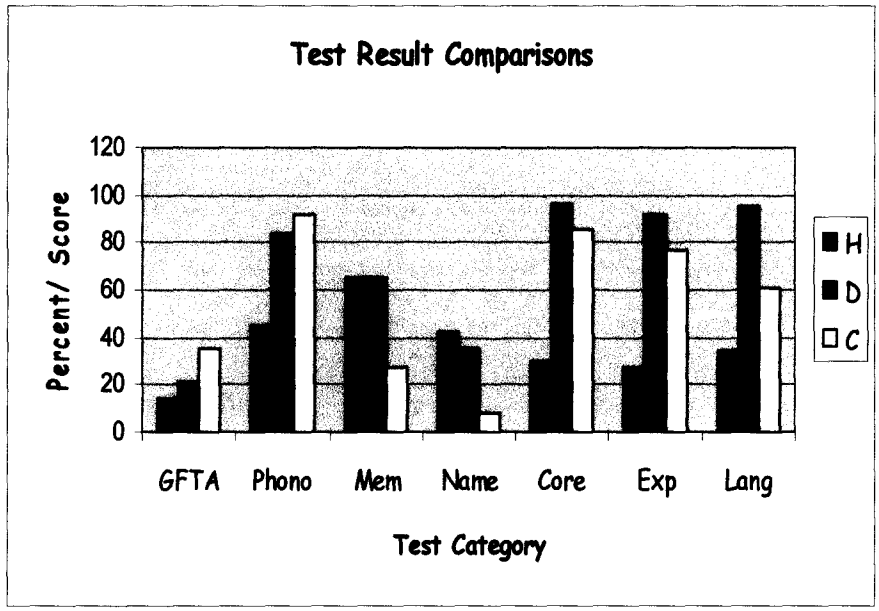
This slide begins with the data of the early measurements (from the initial samples). Subject H had a pause time of 0.078, articulation rate of 1.756, and speaking rate of 1.62. He scored within the 50th percentile of the Mac Arthur Communicative Developmental Inventory and had an MLU of 1.24. Subject D had a pause time of 0.11, articulation rate of 1.19, and speaking rate of 1.05. He scored within the 75th percentile of the MCDI and had an MLU of 1.27. Subject C had a pause time of 0.038, articulation rate of .69, and speaking rate of .66. He scored within the 30th percentile of the MCDI and had an MLU of 1.08. As it is depicted Subject C is behind the two subjects for each measure, as we would believe this to stay congruent three years later. Restating this sentence are these measures reliable in predicting communication skills in three years? This slide does have speaking rate added along with the early measurements. We did not find a huge difference between articulation rate and speaking rate as how Smith found, for this reason we stuck with articulation rate for the early measurement.

Three Years Later

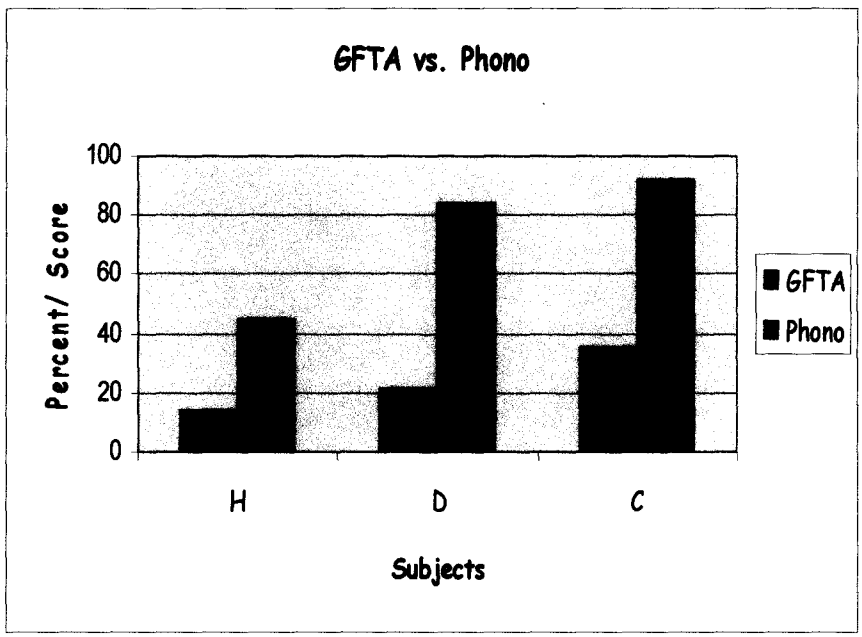
Percentile ranks (above the 16th percentile is within normal limits)

Subjects	GFTA	Phono	Memory	Name	Core	Exp	Lang
H	14	45	65	42	30	27	34
D	21	84	65	35	96	92	95
C	35	92	27	8	86	77	61

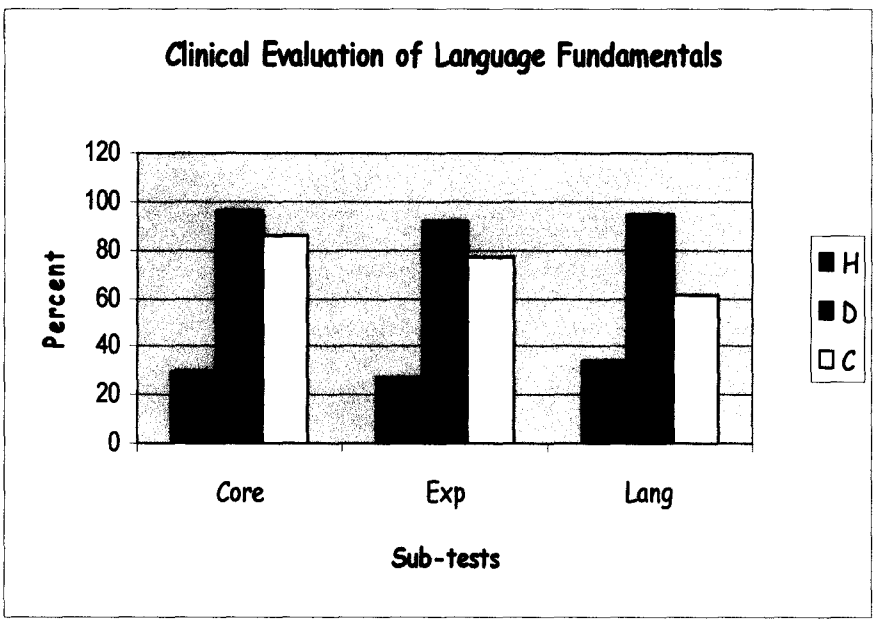
To begin, we will be looking at the GFTA scores. Subject H scored within the 14th percentile on this test. This score puts him below normal limits; any score above the 16th percentile is within normal limits. However, subject H scored within normal limits through out the six other measurements. Contrasting with Subject H low GFTA percentile, he scored the highest on the Memory and Naming sub-test. This does contradict with what we would have thought. Subject H had the fastest articulation rate three years prior; we would have believed him to have scored the highest on this test as well as across the board. Subject C scored highest on the Phonological Awareness sub-test and on the GFTA. Subject C did score below normal limits on the Naming sub-test, however, we do know from his mother he does not do well under pressure, causing his low score. Subject D contained no variability among follow up assessments. To conclude on this slide, all subjects did score within normal limits on each test except for the two boxes that are shaded.



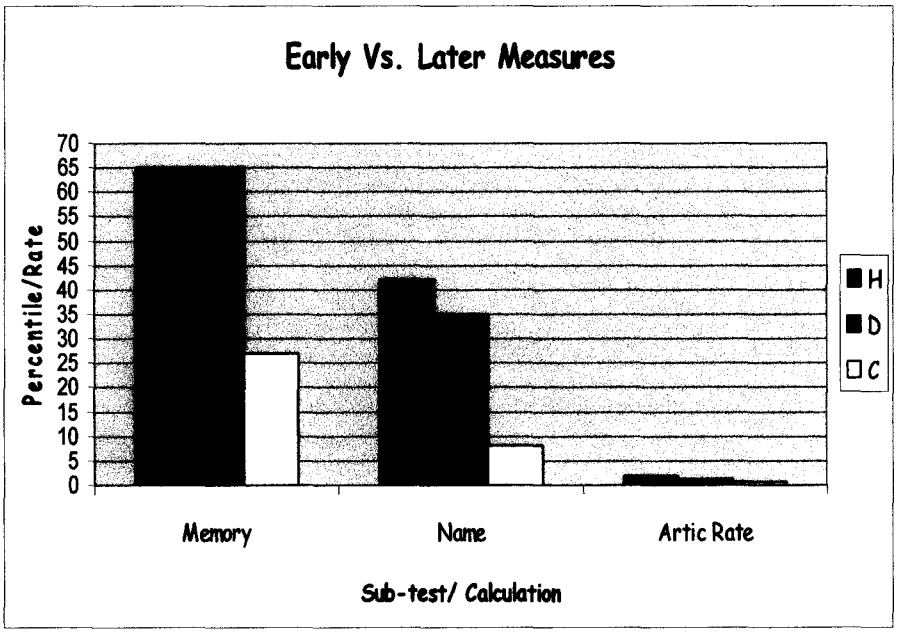
This is a visual representation of the data explained. Again you can see how each subject scored. Moving on we will now examine the patterns that are present when comparing the initial to the follow-up assessment on this next graph.



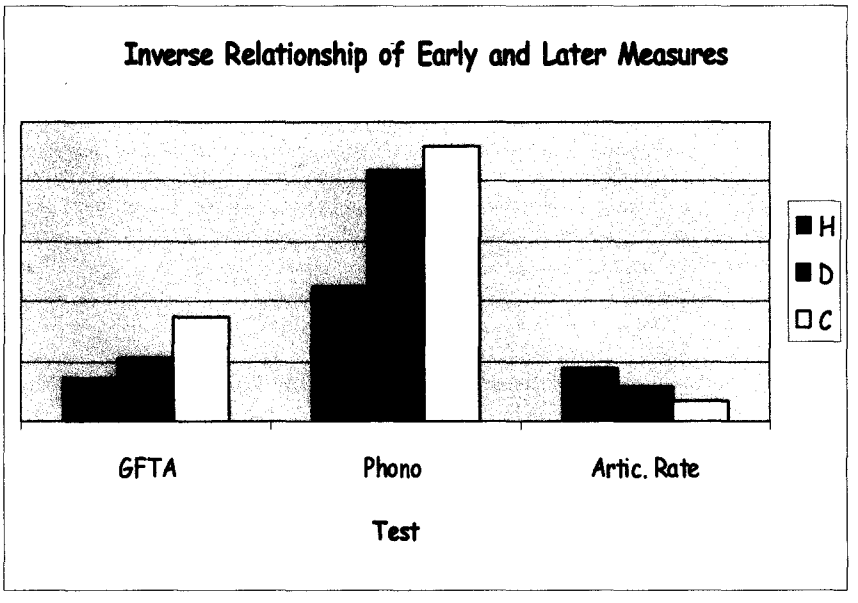
These two measures: GFTA and Phonological Awareness were similar for these three subjects in terms of how each subject scored. This data basically contradicts what we believed would have happened.



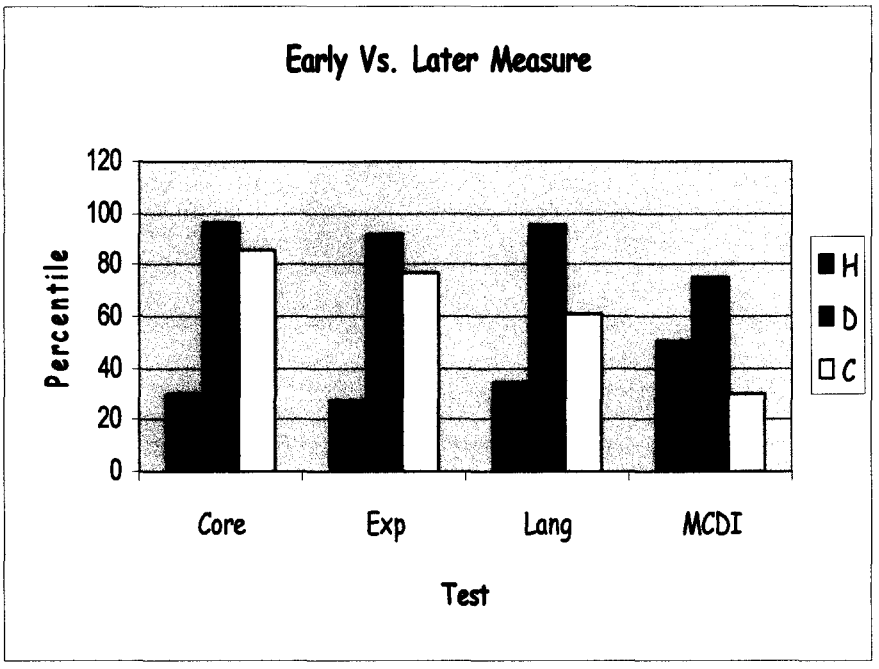
On the CELF P2, subject D scored above Subject H and Subject C. This slide addresses the later assessment comparison between the subjects' percentiles. In two slides we will take this later measure and compare it to the MCDI.



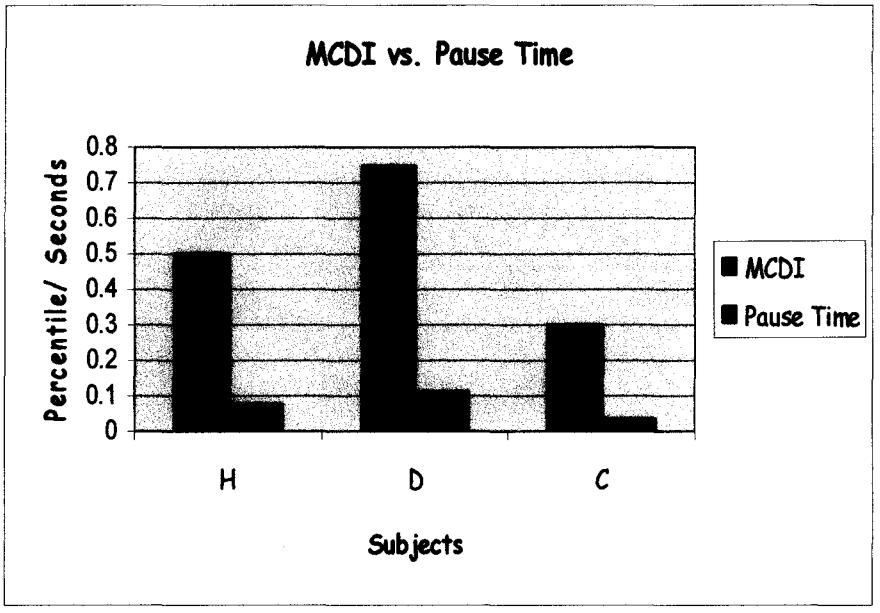
The Sub-tests on the CTOPP: Memory and Naming developed the same outcome as the early measurement, articulation rate.



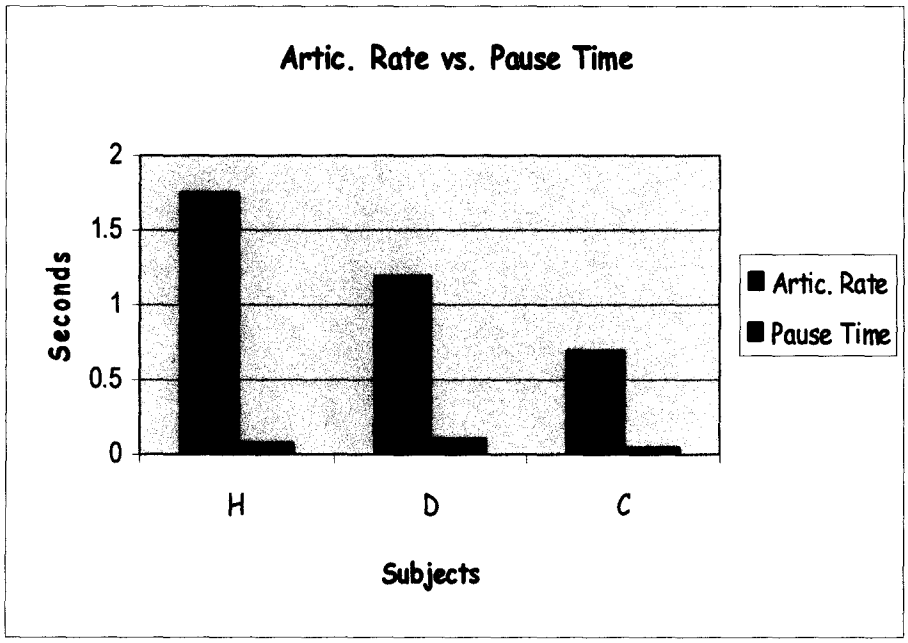
Considering the fact that Subject H had the highest articulation rate we would have expected him to have the highest percentile markings between subjects.



Like addressed before, Subject D scored the highest on the CELF P2 test as was he in the highest percentile for the Mac Arthur Communicative Developmental Inventory.



Looking at MCDI and pause time measures, considering the truth that each are early measurements they too follow the same pattern. This would make sense, the MCDI evaluates what the child can say or is saying at the present time. If the child does not have many words in speech production, the proportion of pausing time would be low.



Leading us to Articulation rate versus Pause time, these two measures also follow the same graphical representation. If one speaks faster, having more syllables in speech production would mean their proportion of pausing time would be higher than compared to a child with few syllables in speech who would have a low proportion of pausing time.

Result Interpretations:

We tested three children who were typical at 21-24 months of age. Three years later when follow-up assessment was completed subject H is found to be atypical and can be said to have mild/speech language impairment. His score on the GFTA (14% tile) categorizes him as atypical. In addition, he did score within normal reading scores which by Smith's research in congruent. By saying this I impose that subject H did not have a slow articulation rate or speaking rate which would indicate in his adolescent years, he would not have a reading disability, not taken into account parent history. He had atypical areas of syntax but the other areas tested brought his score within normal limits. We can ask ourselves was there something different in his early measurements than the other two subjects?

Subject H had faster articulation rate than subject D and subject C. However, there is no known normal articulation rate found for toddlers which does imply the large range for this measure. Our Data and Smith's data do not comply with one another. Smith found no significant correlation with articulation rate between his groups tested. We found that articulation rate and speaking rate where very similar and stood the same patterns when comparing early measures with later measures.

Overall proportion of pausing time had no influence on later measures. Articulation rate had the inverse affect when looking at GFTA percentile and phonological awareness scores for each subject. Our hypotheses do not prove to be true in the matter that articulation rate and expressive vocabulary do not predict later speech skills. We have to take into consideration that this is preliminary data and the research sample size is small.

References

* 1. (Rescorla, Leslie. (Apr 2005) Journal of Speech, Language, & Hearing Research. *Age 13 Language and Reading Outcomes in Late- Talking Toddlers*, pp.459-472.)

* 2. Hoff, E. (2005). Language Development. (3rd Edition). Belmont, CA: Thomson Wadsworth.

* 3. "Language and Speech Development in children." 10 September 2007. http://www.childdevelopmentinfo.com

* 4. Smith. A., Roberts, J., Smith, S.L., Locke, J.L., Bennett, J. (2006). Reduced Speaking Rate as an Early Predictor of Reading Disability. American Journal of Speech-Language Pathology, 15, 289-297.